

# Nucleon Resonance Studies from Exclusive KY Electroproduction

- Progress on understanding the systematics associated with the measured  $\gamma_{\nu}pN^*$  electrocouplings up to  $\sim 1.6$  GeV has come about by comparisons of extractions from independent analyses of different exclusive channels - e.g.  $\pi N$  vs.  $\pi\pi N$
- In the upper end of the  $N^*$  excitation region, KY can be used as an independent check against the electrocouplings extracted from  $\pi\pi N$  where the coupling to  $\pi N$  for some states is small.
- The quality of the KY data measured from CLAS is as good as the data measured in  $\pi\pi N$  and it is more finely binned in  $Q^2$ ,  $W$ ,  $\cos \theta_K^{c.m.}$ .
- KY reaction models are still not developed sufficiently to describe the available data  $\Rightarrow$  we do not yet have an extraction tool to fit the CLAS data (or the upcoming CLAS12 data) for KY.

## Recent Papers:

D.S. Carman, R.W. Gothe, V.I. Mokeev, C.D. Roberts, *Particles* 6, 416 (2023)

D.S. Carman, K. Joo, V.I. Mokeev, *FBS* 61, 29 (2020)

M. Mai, *Eur. Phys. J. A* 59, 286 (2023)

Y.-F. Wang et al, arXiv:2404.17444, (2024)

# KY Reaction Models

At present no reaction model has been able to fully describe the available KY electroproduction data in the resonance region (*although encouraging developments are in progress*).

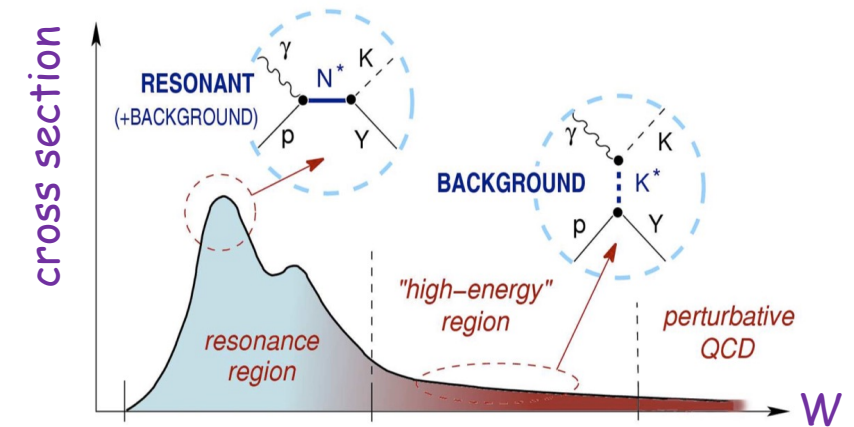
A model that describes the KY data well is necessary to extract the  $\gamma_{\nu}pN^*$  electrocouplings from the existing lower  $Q^2$  CLAS data and the planned higher  $Q^2$  CLAS12 data

## Single Meson Analysis:

- Unitary Isobar Model and Fixed- $t$  Dispersion relation approaches (Kaon-MAID)
- Regge + Resonance model (Ghent)
- Isobar models (T. Mart, O. Maxwell, P. Bydžovský)

## Multi-Channel Analysis:

- Bonn-Gatchina multi-channel PWA
- Jülich-Bonn-GWU coupled-channel framework
- Argonne-Osaka dynamically coupled-channel model



Such a model must incorporate the  $\gamma_{\nu}pN^*$  electrocouplings from the available CLAS results for  $W < 1.8$  GeV and estimates for the excited states in the mass range up to 3 GeV

- Need to allow for possibility to:
  - a) Vary resonant/non-resonant parameters
  - b) Implement additional phenomenological terms to fit to the data
  - c) Simultaneously fit the  $\gamma p$  and  $\gamma^* p$  data